

## Original Research Article

# Comparative assessment of hearing in various tympanic membrane perforations in patients at Bhuj, Kutch, Gujarat, India: a cross sectional study

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### ABSTRACT

**Background:** The objective of the present study was to correlate the size and site of perforation with hearing loss in chronic suppurative otitis media (CSOM).

**Methods:** The cross sectional study was conducted among a purposive sample of first 100 consecutive patients of unilateral inactive mucosal CSOM, who underwent myringoplasty at Department of otorhinolaryngology and Head and Neck Surgery Gujarat Adani Institute of Medical Science, Bhuj, Kutch, Gujarat. One hundred consecutive patients fulfilling the inclusion criteria were included in the study. In all the patients, a detailed history and a thorough ENT examination was followed by hearing assessment and measurement of the size of the perforation.

**Results:** Infection was the most common etiology of tympanic membrane perforation in 92 (92%) cases and trauma in 08 (08%) with otorrhea as the most common presenting complaint. Half of the cases were in the age group of 20–30 years. Seventy-nine percentage cases had mild hearing loss whereas 19% had moderate hearing loss. Anterior quadrant perforations on an average had 31.4 dB hearing loss, whereas there was 43.9 dB average hearing loss in posterior quadrant perforations.

**Conclusions:** It was observed that there is direct relationship between size and site of perforation and loss of hearing. There was less hearing loss in small sized perforations. Posterior quadrant perforations and malleolar perforations (MLs) had a greater hearing loss than anterior, multiple quadrant, or non-MLs.

**Keywords:** Hearing, Otorrhea, Perforation, Tympanic membrane

### INTRODUCTION

Chronic suppurative otitis media (CSOM) is an inflammation of a part or whole of the mucoperiosteal lining of the middle ear cleft. It is a highly prevalent disease of the middle ear. Although the incidence and prevalence of CSOM has decreased in recent decades, due to improving hygiene and treatment, it is still a major health problem in both developing and developed countries.<sup>1,2</sup> The tympanic membrane (TM) emulates an irregular cone and is about 9 mm in diameter. It is firmly attached to the malleus at the lateral process and at the

umbo. The middle ear couples sound signals from the ear canal to the cochlea chain. The major transformer mechanism within the middle ear is the ratio of the TM area to the stapes footplate area (the areal ration). The TM gathers force over its entire surface and then couples the gathered force to the small footplate of the stapes. Human TM has an area that is 20 times larger than the footplate, thus, if the transformer action of the areal ratio is “ideal,” the sound pressure applied to the inner ear by the stapes footplate should be 20 times or 26 dB larger than the sound pressure at the TM.

The primary mechanism of conductive loss caused by a perforation is a reduction in ossicular coupling caused by a loss in the sound pressure difference across the TM. Perforation-induced losses are greatest at the lowest frequencies and generally decrease as frequency increases. Perforation size is an important determinant of the loss; larger perforations result in larger hearing losses.<sup>3</sup> This study has been undertaken to evaluate the relationship between the location and size of perforation of TM and the magnitude of conductive hearing loss.

## METHODS

The Cross sectional study was conducted among a purposive sample of first 100 consecutive patients of unilateral inactive mucosal CSOM, who underwent myringoplasty at Department of otorhinolaryngology and Head and Neck Surgery Gujarat Adani Institute of Medical Science, Bhuj, Kutch, Gujarat. Present study was conducted from December 2014 to March 2015 for 4 months. Ethical approval was taken from institutional review board and ethical committee of the college and written informed consent was obtained from all participants. Patients of both genders, of age 18–52 years, who had dry central perforation with conductive hearing loss, healthy middle ear mucosa, and normal Eustachian tube function, were included in this study. Patients below 18 years of age, and with active disease, tympanosclerosis, revision surgery, mixed or sensory neural hearing loss, CSOM atticofacial type, ossicular chain fixation, or disruption were excluded from the study. A thorough history was taken in each case, followed by detailed examination and relevant investigations.

Audiometric assessment was performed using a clinical audiometer - Primus Audit data calibrated according to ISO standard in a sound treated room. A preoperative pure tone audiometry was done to find out hearing level of the patient. "Hearing level" was defined as the mean air conduction threshold at 500, 1000, 2000, and 4000 Hz, and average of these frequencies was calculated to measure the hearing level. Sterile piece of transparent plastic paper (with graph imprinted on it) was kept over the perforated TM, under operating microscope with magnifications 2.5 X. Number of squares occupying the perforation was counted. Half or more of any square overlying the perforation, was taken to be one whole square and smaller than half a square mm was not counted. The area of perforation was calculated by counting the number of squares on the graph paper covering the perforation and a record was made. The perforation was divided into small, medium, and large depending upon the size of perforation as shown in Table 2. The average surface area of an intact TM was taken as 64.3 sq.mm. The site of each perforation was determined anterior or posterior with respect to an imaginary line drawn across the TM at the level of manubrium. Perforations were divided into malleolar or non malleolar depending upon whether the malleus was involved or not.

## RESULTS

The study comprised 100 cases of unilateral inactive mucosal CSOM. The most common symptoms were ear discharge and hearing loss in all the patients. Infection was the most common etiology of TM perforation in 92 cases (92%) and in eight patients (8%), trauma was the cause of TM perforation. Otorrhea was the most common presenting complaint in 85 cases (85%) followed by hearing loss in 82 cases (82%) and itching in ear in 10 cases (10%). There were 8 cases (8%) of traumatic perforations. Age range of the patients was between 18 and 52 years. The maximum number of patients, i.e., 50 (50%) was in the age group of 20–30 years and the least number i.e., 5 (5%) in the range of 41–50 years. The number of patients also decreased with the increase in age. The number of males was more than the number of females. There were 58 (58%) males and 42 (42%) females in the study.

All the cases included in the study had unilateral inactive mucosal disease with central perforation. It was observed that average hearing loss ranged from 16 to 65 dB (conductive). Maximum number of cases were found to have mild hearing loss (79%) followed by moderate hearing loss (19%). The hearing loss in the study ranged between 26 and 70 dB. In maximum number of cases, there was mild hearing loss (79%) as in Table 1.

**Table 1: Average hearing loss in 100 dry tympanic membrane perforations.**

Grade of hearing loss	Average hearing loss (dB)	Number of ears (n=100)	Percentage
<b>Mild</b>	26-40	79	79
<b>Moderate</b>	41-55	19	19
<b>Moderately Severe</b>	56-70	02	02

**Table 2: Hearing loss according to size of perforation.**

Size of perforation (mm <sup>2</sup> ) (%)	Size of perforation (mm <sup>2</sup> ) (%) number of ears	Average loss (dB)
<b>1-16</b>	55	31.4
<b>17-32</b>	43	43.7
<b>More than 32</b>	2	59.8

From Table 2 it was noticed that loss of hearing was directly proportional to the size of the perforation. The larger the perforation, more the hearing loss. It was observed that hearing loss was slightly greater in posterior perforations, than the anterior perforations and perforations involving multiple quadrants. The hearing loss of the entire study group was divided into two parts – malleolar and non-malleolar perforation (ML). TM perforations touching the handle of malleus were termed as ML and those not touching the handle of malleus were

termed as non-MLs. The hearing loss was found to be more in ML.

## DISCUSSION

The cross sectional study was conducted among a purposive sample of first 100 consecutive patients of unilateral inactive mucosal CSOM, who underwent myringoplasty at Department of otorhinolaryngology Gujarat Adani Institute of Medical Science, Bhuj, Kutch, Gujarat. Out of the 100 patients studied, 58 were males and 42 were females, suggesting slight male preponderance. Average hearing loss ranged from 16 to 65 dB. Seventy-nine percentage cases had mild hearing loss, whereas 19 (19%) and 02 (02%) cases had moderate and severe hearing loss, respectively. The average hearing loss in small (1–16 mm<sup>2</sup>) perforations was 31.4 dB, while that of medium (17–32 mm<sup>2</sup>) perforations was 43.7 dB, and large (>32 mm<sup>2</sup>) perforations was 59.8 dB, suggesting that the hearing loss is directly proportional to the size of the perforation. According to our study, maximum number of cases had mild hearing loss, and many patients were even not aware of the hearing loss. According to studies conducted by Anthony et al, Maharjan et al, Bhusal et al, Nepal et al, Ibekwe et al and Mehta et al hearing loss was greater in larger perforations as compared to small perforations, which is in agreement with our study where hearing loss ranged from 43.7 to 59.8 dB in perforation over 17 mm in size.<sup>4,9</sup> It was further observed that more the involvement of the vibratory area, more was the hearing loss.

In this study, hearing loss was found to be more in posterior perforations, which was also observed by Maharjan et al, Nepal et al, Nahata et al, Bhusal et al.<sup>5,7,10</sup> Contrary to this, Ibekwe et al, Mehta et al, Lerut et al and Pannu et al did not find significant difference in the hearing loss in anterior versus posterior quadrant perforations.<sup>8,9,11,12</sup> We found that the hearing loss resulting from ML was more than that of non-MLs. same observations were made by Pannu and Kharadi et al.<sup>12,13</sup>

The average hearing loss for anterior perforation was 31.4% and for posterior and multiple quadrants perforations, it was 43.9% and 41.7%, respectively. There is a small difference in average hearing loss in different sites of perforations. So effect of site, if any, on the hearing loss was small. The average hearing loss in ML for small perforations was 27.5 dB for moderate perforations was 30.7 dB and for large perforations was 48.5 dB, while in non-MLs it was 26.7 dB and 29.3 dB for small and medium perforations, respectively.

## CONCLUSION

It is thus concluded that the hearing loss is more in larger MLs and posterior perforations as compared to non-malleolar anterior perforations.

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